

## **Distillation of Gasoline**

### Scope

This method covers the distillation of motor gasolines and similar petroleum products.

### Summary

A 100 ml sample is distilled under prescribed conditions which are appropriate to its nature. Systematic observations of temperature readings and volumes of condensate are made and from these data the results of the test are calculated and reported.

### Comments

When the sample is measured for distillation, it should be at a temperature of 55 - 65°F. Samples are stored in an explosion proof refrigerator that is usually less than 55°. Therefore, the sample may need to sit at room conditions for a while to reach the proper temperature. Samples of materials that visibly contain water are not suitable for testing. It is possible to conduct this test on two samples at the same time using adjoining stills. Record all volumes in the graduate to the nearest 0.5 ml and all thermometer readings to the nearest 1°F.

### Apparatus and Materials

- A. Distillation flask: 125 ml.
- B. Graduated cylinder: 100 ml.
- C. Thermometer: ASTM 7F.
- D. Distillation apparatus suitable for petroleum products.

### Procedure

- A. Fill the condenser box on the distillation apparatus with ice and water so as to cool the tube to 32-34°F.

- B. Remove any residual liquid in the condenser tube by swabbing with a piece of soft, lint-free cloth attached to a cord or copper wire.
- C. Bring the temperature of the sample to 55-65°F. Measure 100 ml of the sample in the graduated cylinder and transfer it as completely as practicable to the distillation flask, taking care that none of the liquid flows into the vapor tube.
- D. Fit the thermometer, provided with a snug-fitting stopper, tightly into the neck of the flask so that the bulb is centered in the neck and the lower end of the capillary is level with the highest point on the bottom of the inner wall of the vapor tube.
- E. Place the flask in the distillation apparatus and, by means of a stopper through which the vapor tube has been passed, make a tight connection with the condenser tube. Make sure the flask is in a vertical position and that the vapor tube extends a distance of 1 to 2 inches into the condenser tube.
- F. Place the graduate under the lower end of the condenser tube so that the end of the condenser tube is centered in the graduate and extends therein for a distance of at least 1 inch but not below the 100 ml mark. Make necessary provisions so that the temperature around the graduate will remain at 55-65°F during the distillation. Cover the graduate with blotting paper, or similar material, suitably weighted, which has been cut to fit the condenser tube snugly.
- G. Note and record the prevailing barometric pressure.
- H. Turn the still heating coil on and start a stop watch. Apply heat to the flask and contents so that the time interval between the first application of heat and the initial boiling point is 5 - 10 minutes.
- I. Immediately after the first drop comes over, stop the stopwatch and record the time to initial boiling point and the boiling point temperature. Move the graduate so that the tip of the condenser touches its inner wall.
- J. Continue to regulate the heating so that the rate of condensation into the graduate is uniform and averages 4 - 5 ml/min. At the 5 ml condensate point start the stopwatch and record the temperature. As each minute is passed on the stopwatch, record the volume of condensate to keep track of the rate.
- K. In the interval between the recovery of 5 ml and the end of the distillation observe and record the temperature at each multiple of 10% recovered from 10 to 90 inclusive. The stopwatch can be stopped at the 80 ml mark.

- L. When the residual liquid in the flask is about 5 ml start the stopwatch and make a final adjustment in the heat, if necessary, so that the time from 5 ml of liquid in the flask to the end point is between 3 and 5 minutes. The end point is the maximum observed temperature after which the temperature begins to drop. Stop the stopwatch at the end point and record the temperature and the time from 5 ml remaining to the end point.
- M. Turn off the heat, tilt the flask and allow it to cool.
- N. While the condenser tube continues to drain into the graduate, observe the volume of condensate at 2 minute intervals until two successive observations agree. Measure this volume accurately, and record it, to the nearest 0.5 ml, as percent recovery.
- O. After the flask has cooled, pour its contents into a small graduate and allow to drain until no appreciable increase in the volume of liquid in the graduate is observed. Record this volume as percent residue.

#### Calculations

- A. Deduct the percent total recovery from 100 to obtain the percent loss.
- B. When the report is to be based on thermometer readings corrected to 760 mm Hg, obtain the correction to be applied to each thermometer reading by the following equation:

$$C_f = 0.00012 (760 - P)(460 + t_f)$$

where:

$C_f$  = Correction to be added algebraically to the observed thermometer reading  $t_f$ .

$P$  = Prevailing barometric pressure, mm Hg, at the time of the test.

- C. If the thermometer readings are corrected to 760 mm Hg pressure, the actual loss shall be corrected to 760 mm Hg pressure according to the equation:

$$\text{Corrected loss} = AL + B$$

where:

L = Percent loss as calculated from test data and

A and B = Numerical constants, the values of which depend upon the prevailing barometric pressure. Consult the reference for a table of these values.

- D. To report thermometer readings at prescribed percentages evaporated, calculate each required thermometer reading as follows:

$$T = TL + \frac{(TH-TL)(R-RL)}{(RH-RL)}$$

where:

T = Thermometer reading at the prescribed percent evaporated.

R = Percent recovered corresponding to the prescribed percent evaporated.

RH = Percent recovered adjacent to, and higher than R, at which a thermometer reading "TH" was noted.

RL = Percent recovered adjacent to, and lower than R, at which a thermometer reading "TL" was noted.

- E. All of the above calculations can be done by computer.

### Bibliography

Annual Book of ASTM Standards (1987) Vol. 05.01, Sec. 5, ASTM, Philadelphia, PA, D  
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